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Land-cover regions research gets NASA grant; paper on data base wins ERDAS award

Producing the Seasonal Land Cover Regions Map of the conterminous United States involved some ground-breaking work in remote sensing that has won accolades from a leading professional society, as well as financial support from NASA, said University of Nebraska-Lincoln research geographer James W. Merchant.

The Center for Advanced Land Management Information Technologies (CALMIT), of the UNL Conservation and Survey Division (CSD), has received a 3-year $399,000 grant from NASA to continue development of the world's first detailed global land-cover data base, said Merchant, associate director of CALMIT. The research is a collaborative effort between CALMIT and the U.S. Geological Survey's Earth Resources Observation Systems (EROS) Data Center in Sioux Falls, S.D.

The methods used to create a new Seasonal Land Cover Regions Map of the United States--an outgrowth of an EPA effort to identify areas of nonpoint-source pollution--will serve as a model for the global project. Merchant said similar techniques are currently being used to prepare an updated version of the U.S. land-cover data base that will be expanded to include all of North America. It will be complete in spring of 1995; then other continents will be mapped.

"The original U.S. analysis was based on satellite imagery covering March through October

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Study of water flow in Kiowa Wildlife Area gets grant

Two University of Nebraska-Lincoln water scientists have received a 1-year, $24,640 grant from the Nebraska Game and Parks Commission to study water-flow patterns in the Kiowa Wildlife Management Area. UNL Conservation and Survey Division researchers Anne Matherne and David Gosselin are collecting information that will help Game and Parks develop a management plan for the area.

The Kiowa Wildlife Management Area was a private farm primarily used for irrigated crops and grazing before it was acquired by the Nature Conservancy and given to Game and Parks, Matherne said. The area is located in the North Platte River valley two and a half miles south of Morrill, Nebraska, in Scottsbluff County.

Two distinct types of wetlands cover much of the 326-acre area. Saline, or salt-marsh, wetlands lie in the northwest, and the remainder of the wetlands are freshwater. Although the Mitchell and Gering Irrigation Canal runs nearby and probably contributes some water to the area, the wetlands appear to be a natural landform.

"I think historically it was a wetland area fed by natural seeps and probably contributions from the river," Matherne said. "If you look back at 1930s aerial photos, you can see open water and a small stream feeding the Platte River."

Several types of data will be used to identify the water-flow patterns necessary for the development and maintenance of the wetlands. Daily data

(See **Wildlife Area** *continued on page 3)*

Enhancing biodiversity aim of GAP Analysis Program

A new program of the National Biological Survey will use geographic information systems to analyze Nebraska's critical habitat with the aim of achieving greater conservation of biological diversity. The Nebraska GAP Analysis Program, set to begin this summer, will be cooperatively managed by James W. Merchant, associate director of the University of Nebraska-Lincoln Center for Advanced Land Management Information Technologies (CALMIT), and Dennis E. Jelinski of the UNL Forestry, Fisheries and Wildlife department. The effort will also enlist the help of many cooperating organizations, including the Nebraska Game and Parks Commission, the NU State Museum, private businesses, nonprofit groups, universities and other governmental agencies, in seeking to identify the degree to which all native plant and animal species are represented in protected or conservation lands.

"Those species and communities not adequately represented in areas that are being managed for the long-term maintenance of native species constitute conservation 'gaps,'" said a GAP Analysis program handout.

"We want to look at the extent to which critical habitats are protected," explained Merchant, a research geographer with the Conservation and Survey Division's CALMIT. "'Gaps' are areas that are not well protected."

Nebraska is one of the first Great Plains states to start gap analysis. The three-year program will eventually produce a digital database for the state capable of generating map products. Overall, Ne-

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The bimonthly newsletter of the Conservation and Survey Division

Institute of Agriculture and Natural Resources/University of Nebraska–Lincoln

Nebraska mineral values fell 8 percent in 1993

The combined value of mineral production in Nebraska for 1993 was down 8 percent from 1992 values, two University of Nebraska-Lincoln geologists said in an annual report on statewide mineral production.

The "Nebraska Mineral Operations Review, 1993," by Raymond R. Burchett and Duane A. Eversoll, geologists with the UNL Conservation and Survey Division (CSD), said that total mineral-production value for last year was $197.2 million, compared to $214.7 million in 1992, $210.9 million in 1991 and $234 million in 1990.

Values peaked in 1981 at about $316 million and declined to $185 million in 1989.

Nebraska's non-fuel mineral values also fell after a slight recovery in 1992. Sand and gravel for construction and crushed stone, which normally dominate non-fuel mineral-production values, increased 22 percent in the last year.

The value of oil and gas fell from $99.5 million in 1992 to $76.5 million in 1993, the Institute of Agriculture and Natural Resources researchers said in the report. Natural-gas production value actually increased 82 percent, from $2.1 million in 1992 to $3.8 million in 1993. Petroleum production value decreased 25 percent, from $97.4 million to $72.6 million, causing the overall decline. In 1992, 1,682 wells produced 5,474,188 barrels of oil, compared to 1,582 wells producing 4,868,255 barrels in 1993. Of the 114 wells drilled in 1993, 61 were for exploration, 53 for development and 10 were classified as tests or miscellaneous service. Cheyenne County had the largest number of completed exploration and development wells, followed by Kimball, Hayes, Hitchcock and Banner counties.

The state's one active uranium mine, located near Crawford in Dawes County, produced about 600,000 pounds of yellow-cake uranium, valued at $6 million, in 1993, a 50 percent increase from 1992 production.

The report is available from CSD, 113 Nebraska Hall, University of Nebraska-Lincoln, Lincoln, Neb., 68588-0517 for $3.00 plus appropriate city and state sales tax.

Earth-science education network sponsors two workshops

Several Nebraska teachers learned more about rocks and water at a two-day workshop on earth-science topics July 8 and 9. The workshop, sponsored by the Nebraska Earth Science Education Network (NESEN) was the product of a cooperative effort by K-12 and post-secondary educators who have sought to improve earth-science knowledge for K-12 students. The workshop was held at the Conservation and Survey Division.

Participants in another pair of NESEN workshops, to be held July 15 and 16, will be immersed in the subject of water. The hydrologic system of Nebraska's rivers and groundwaters will be emphasized.

Participants in the first workshop, entitled "What's in a Rock?" learned what rocks are made of and how they are formed. They took a field trip to examine rocks and river sediment and learned how rocks reveal geologic history. Marv Carlson, research geologist and Dave Gosselin, a NESEN coordinator and research geochemist, both with the University of Nebraska-Lincoln Conservation and Survey Division (CSD), were the instructors for that workshop.

Gosselin said that the NESEN idea was introduced at a meeting of the Nebraska Association of Teachers of Science. The teachers were enthused about it and a steering committee was created. During the first couple of meetings, teachers and scientists worked on finding common ground.

"The scientists (at first) were aiming at things that teachers didn't need," Gosselin said. "Teachers needed interactive teaching (materials) instead of lecturing (of) content knowledge."

Consequently, NESEN coordinators put together workshops where teachers actively apply earth-science concepts to some of Nebraska's natural resource systems. Map interpretation and a using a soil survey will be covered at a pair of workshops next summer. NESEN coordinators plan to develop a continuing series of workshops available to all Nebraska teachers.

Resource News is a quarterly publication of the Conservation and Survey Division, 113 Nebraska Hall, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, 68588-0517, distributed free to those who request it. To receive it, write to the address above. In addition, the Resource News audience will receive Resource Notes, the annual report of the division. **The Conservation and Survey Division is the agency designated by statute to investigate the geologically related natural resources of the state, to make available to the public the results of these investigations and assist in the development and conservation of these resources.** The Conservation and Survey Division provides information to all people regardless of sex, age, race, color, religion, national origin, sexual orientation, veteran's or marital status or handicap. Background of nameplate depicts the rock column from the Geologic Bedrock Map of Nebraska. Layers shown are (from the bottom) Precambrian, Cambrian, Ordovician, Silurian and Devonian rocks.

Land cover *continued from page 1*

1990," Merchant said. "This time, we will examine 1992 data for the entire year. For example, in southern areas, you have some winter growth, so we plan to use some winter images."

Building an accurate, current data base on land use and land cover involves collecting several different types of information, according to the NASA grant proposal. The principal data are satellite images that record light reflectance from vegetation over a very large area, up to 2,700 kilometers wide. These images are analyzed by computing a "greenness" index for each 1-kilometer area, or pixel, in the image. Researchers will explore using satellite images that reveal greater detail, such as those from Landsat, in conjunction with the 1-km resolution images.

Information on ecoregions, elevations and climatic characteristics are included in the data base, as well as maps of state and county boundaries, major rivers and lakes. CSD researcher Limin Yang, working at the EROS Data Center, will focus on ways to evaluate interannual climatic changes and their effect on land cover.

The Land Cover Characteristics Data Base for the conterminous United States is currently available on CD-ROM. The data base for North America, including raw, derived, ancillary and tabular data, classification and documentation, will also be made available on CD-ROM. The Seasonal Land Cover Regions Map of the U.S., which was derived from the original data base, has been so popular it has sold out. Another printing is expected soon, Merchant said.

Several different types of data were combined and then classified into 159 distinct land-cover characteristics for the map. Various colors represent characteristics of cropland, shrubland, grassland, wetland or forest vegetation.

A paper describing how data were combined to classify land-cover characteristics received the ERDAS Award for best scientific paper in remote sensing. "Using Multisource Data in Global Land-Cover Characterization: Concepts, Requirements, and Methods," was published in the June 1993 issue of Photogrammetric Engineering and Remote Sensing. ERDAS is an Atlanta company specializing in image-processing software that donates money for the award.

Former CALMIT researcher Jesslyn Brown, currently with Hughes STX Corporation at Sioux Falls, S.D., was the senior author. Merchant, Thomas R. Loveland of the U.S. Geological Survey and Bradley C. Reed and Donald O. Ohlen, both of Hughes STX Corp., co-authored the paper. Brown, Loveland, Reed and Ohlen all conduct research at the EROS Data Center.

Wildlife Area *continued from page 1*

from the weather station at Morrill will help determine the effect of precipitation.

Groundwater is presumed to be the primary source of water maintaining the wetlands. Several groups of water-level measuring devices known as "piezometer nests" have been installed in a grid pattern throughout the area. Water-level and water-flow readings are taken weakly. The combination of vertical and horizontal measurements will allow the researchers to track groundwater seepage into and out of the wetlands.

Placement of the piezometer nests, which will include coring, will also provide details about the sediment and bedrock beneath the wetlands. Bedrock structure can affect the direction, speed and volume of groundwater flow.

Researchers have identified other factors in the area affecting the flow of groundwater. The Mitchell and Gering Irrigation Canal, south of the Kiowa Wildlife Management Area about 32 feet above the wetlands, is unlined and connected to the sediment layer underlying the wetlands. The researchers are collecting data to illustrate how the canal, a tile drain and a culvert affect the groundwater-flow cycle in the area.

Maps of groundwater flowpaths will be combined with water- and soil-chemistry measurements to develop a model of salt-marsh formation and the interaction between saline and freshwater wetlands.

"What we're looking for is a picture of how the salt-marsh areas are developed and maintained so Game and Parks can continue to maintain both the freshwater and salt marsh components of the wetland," Matherne said.

The study will be compared to available historical data from soil surveys, aerial photography and precipitation and air-temperature records to help researchers evaluate the accuracy of their model. They will also try to identify key parameters for continued monitoring of the area to aid in future management decisions.

GAP Analysis *continued from page 1*

braska's GAP objectives are to map existing statewide vegetation and other land cover; determine the present distributions of native animal species; determine the extent and importance of places of native species richness; compare the distributions of vegetation communities with existing land uses; compare places of species richness with existing land uses; and provide an objective basis for a statewide and national biodiversity management strategy.

The research will combine data on actual vegetation distribution, mapped from satellite imagery and other records, with distributions of native animal species, mapped by using state museum and other agency records, in conjunction with known habitat ranges. Maps of species-rich areas, individual species of concern and vegetation types will be overlaid on maps of land ownership and land use, showing where conservation efforts need to be targeted. For more details, contact Jim Merchant at (402) 472-7531.

New publications from Conservation and Survey:

--Geologic Framework of the Niobrara River Drainage Basin and Adjacent Areas in South Dakota Generally East of the 100th Meridian West Longitude and West of the Missouri River: R.F. Diffendal, Jr. and M.R. Voorhies (GSI-9) $3
--Nebraska Mineral Operations Review, 1993: R.R. Burchett and D.A. Eversoll (MP-36) $2
--Fundamentals of Groundwater Contamination: Darryll T. Pederson (EC-11) $4.50
--Clay County Test Hole Log Book (THR-18): $4
--Cass County Test Hole Log Book (THR-13): $8.50

New maps
--The World Map (1:30,000,000): U.S. Department of Defense (GIM-68) $5
--The United States (1:4,560,000): The National Geographic Society (GIM-69) $10
--The United States Shaded Relief (1:7,500,000): U.S. Geological Survey (GIM-70) $3
--The United States by Satellite View (26" x 16-3/4"): U.S. Geological Survey (GIM-71) $3
--Landforms of Conterminous United States--A Digital Relief Portrayal (1:3,500,000): U.S. Geological Survey (GIM-72) $5
--U.S. Congressional Territory Map (1:3,168,000): U.S. Geological Survey (GIM-73) $5
--Indian Tribes Map (19" x 28"): U.S. Geological Survey (GIM-74) $3
--Map of Emerging Nation (29" x 22"): U.S. Geological Survey (GIM-75) $3

Nebraska Geonotes
--Earthquakes in Nebraska (revised): R.R. Burchett (GIM-23) $.50
--Oil and gas facts for Nebraska (revised): R.R. Burchett (GIM-47) $.50
--Mineral facts for Nebraska (revised): R.R. Burchett (GIM-38) $.50

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Coming up: local, state and national meetings and workshops

--Annual Water Resources Tour--formerly the Irrigation Tour, July 25-28, sponsored by the Water Center/ Environmental Programs, University of Nebraska-Lincoln: Flood recovery in Iowa, Illinois and Missouri.
--First International Conference and Workshop on Groundwater Festivals, August 11-12, Lied Conference Center, Arbor Day Farm, Nebraska City. Contact Amy Killhan at the Groundwater Foundation, Lincoln, Neb., 424-2740, or 1-800-858-4844.
--Annual Meeting of the Nebraska Water Conference Council, September 24, 8 a.m. to 11 a.m., UNL East Campus Union.
--Annual Water Policy Forum for University of Nebraska Faculty, September 27, Sponsored by the Water Center/Environmental Programs, the Ak-Sar-Ben Aquarium.
--Thirty-ninth Annual Midwest Groundwater Conference, October 16-18, Radisson Hotel in Bismarck, North Dakota.

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